Rocky Mountain juniper stand on steep, rocky, upper slopes of the south side of Huntsman Mesa, east of Powderhorn, looking west. Relatively late seral, Community Type A. Rocky Mountain juniper 48% cover, muttongrass 37%. A small part of Powderhorn Valley can be seen along the middle left edge of the photo. A lot of stones and boulders on the surface. Coarse Fragment Cover = 54%, Total Live Cover = 106%, Coarse Fragments in Soil = 33. Soil sampled as a Lithic Argiboroll, Loamy-Skeletal, Mixed. Powderhorn Quadrangle. elevation 9,050 ft, 38% 199° (SSW) slope. August 17, 1993.

1. Rocky Mountain Juniper Ecological Series

Table 01-1. Full and short names for the ecological types in the Rocky Mountain Juniper Ecological Series.			
Ecological Type		**Plant Association Code**	**Short Name**
Code	**Name**		
FD01	Rocky Mountain Juniper/littleseed ricegrass–Stony cobbly gravelly Argiborolls–Steep southerly granitic backslopes, 8,300-9,300 ft	JUSC2/PIMI7	Tree juniper–Coarse dark soils–Steep southerly

This series is the same as the *Juniperus scopulorum* Series of Hess (1981-1986), Alexander and others (1986), and Kittel and others (1994), and *Juniperus scopulorum* Alliance of Kittel and others (1996). It includes part of the *Juniperus* Series of Layser and Schubert (1979), though their concept should probably include at least two separate series by our definition. This series is related to the *Juniperus occidentalis* series of the Northern Great Basin and Pacific Northwest and to the *Juniperus scopulorum* series of the Western Great Plains and valleys of the Rocky Mountains.

Stands of this series present a distinctive pattern on aerial photographs, often with individual juniper trees visible, on a steep warm slope. Stands are moderate to large in size, often isodiametric to elliptic in shape.

Vegetation, Climate, Soils

There is considerable debate as to why piñon (*Pinus edulis*) does not occur commonly with juniper stands in the Upper Gunnison Basin (UGB). The two species (piñon and Rocky Mountain juniper) occur together just outside the UGB to the east, southeast (Ramaley 1942, Shepherd 1975), and west. I believe the upper limit of piñon is set by average minimum sustained temperature for any three- to four-week period during the year; and there are few places in the UGB where this is high enough for piñon to grow. Dispersal of the large, edible seeds by Native Americans, birds, or bears is another possible factor, but surely those dispersal agents would have gotten here fairly often.

The UGB contains a few isolated individual piñon trees (Art Haines and Joe Pecor, personal communication). A small stand was recently discovered in the extreme southeast corner of the UGB (Jerry Chonka, personal communication).

Tree production in this series is low, as stands are located on cold, dry slopes that are typically bouldery and steep, and growth is very slow (Hess and Alexander 1986). Crane (1982) indicates that extra moisture or shade after a fire may increase the possibility of juniper seedling survival. Chojnacky (1985) gives volume equations for Rocky Mountain juniper in Colorado. Juniper is sometimes used for fuelwood; otherwise the stands of this series are unsuitable for productive timber management. No vegetation management is recommended except possibly rehabilitation or revegetation for degraded sites. Insect and disease regimes are not documented for the series.

Rocky Mountain juniper sites are likely to be difficult to revegetate, since the shallow, dark, upper horizon of soil is likely to have disappeared after most disturbances. Native species that occur here (blue grama, Indian ricegrass, and Arizona fescue) could be tried, but they are expensive and difficult to obtain.

Table 01-2 shows the climate for the Rocky Mountain Juniper Ecological Series and Table 01-3 shows estimated time periods to establish a stand after a stand-replacing fire.

Table 01-2. Climate.		
Characteristic	**Value**	**Reference**
Precipitation zone	360 mm/yr (300-410 mm/yr) 14 in/yr (12-16 in/yr)	Terwilliger and Tiedeman 1978, Tiedeman and others 1987, local data
Annual air temperature	mean 4.6°C 40.3°F	Tiedeman and others 1987
Fire Group	1. Juniper, piñon-juniper, and piñon woodland associations	Crane 1982

Range Management

Forage production is low to very low. The sites are typically steep, bouldery, and far from water, and seldom used by livestock. Stands are unsuitable range for cattle or sheep due to low production and the high risk of soil loss. Forage production for deer is typically sparse, but these stands do provide cover and habitat for standing. Visibility from most stands is very good. Where these stands have palatable shrubs such as mountain-mahogany (CEMO2) or bitterbrush (PUTR2), they have significant value as browse for deer, and to a lesser extent, elk. These stands are common components of critical winter range for mule deer and elk in the UGB and elsewhere in western Colorado (Terwilliger and Tiedeman 1978, Tiedeman and others 1987).

Table 01-3. Estimated time periods for establishment after a stand-replacing fire in piñon-juniper at Mesa Verde, southwestern Colorado (Erdman 1970, quoted in Crane 1982).

Stage	Time from fire
Skeleton forest and bare soil	0 yr
Annual herbs	2 yr
Perennial grass-forb stage	4 yr
Shrub stage	25 yr
Shrub-open tree stage	100 yr
Climax piñon-juniper forest	300 yr

Several Rocky Mountain juniper series stands in the UGB provide bighorn sheep habitat. West of Saguache near the UGB, sites of a similar type are an important component of low-elevation bighorn sheep winter range, though not their intermediate range or summer-lambing range. Fringed sage (ARFR4) is the only major component of bighorn winter diets that occurs in piñon-juniper stands (Shepherd 1975).

Recreation, Roads & Trails, Scenery

The scenic value of stands in this series may be high, especially when viewed from a distance. Visibility and scenic views are typically very good from within the stands, but few humans come to these sites. Deer and bighorn sheep take advantage of the visibility as protection from predators. Stands are not suitable for dispersed or developed recreation because of steep bouldery slopes, erosive soils, and high winds. There has been very little historic use. These stands are also unsuitable for facilities or development.

Table 01-4. Above-ground production at several Rocky Mountain juniper sites in north-central Colorado (Tiedeman and others 1987)

Vegetation	Average Annual Production, kg/ha/yr
Graminoids	152.6
Forbs	43.7
Shrubs	146.3
Total	356.0

Table 01-5 shows the characteristics of the ecological types within the Rocky Mountain Juniper Series.

Table 01-5. Characteristics of Ecological Types within Ecological Series 1 in the Upper Gunnison Basin. Numbers are shown in form *Average (Minimum-Maximum)*

Code Short Name	No. Samples	Elevation, ft	Avg. Aspect, °M (r) Slope, %	Soil Coarse, %	Depth, cm Mollic, cm	Surface: Coarse, % Bare, %	Cover, % Trees Shrubs Graminoids Forbs	Total Live Cover, % No. Species TLC/NS, %
FD01 Tree juniper– Coarse dark soils– Steep southerly	8	8,920 (8,360-9,240)	171 (0.60) 39 (29-47)	56 (35-73)	51 (28-80) 12 (2-21)	52 (40-66) 9 (1-16)	32 (15-63) 15 (3-29) 41 (10-59) 3 (1-5)	91.4 (51.7-117.5) 32 (25-47) 3.1 (1.4-4.5)

Rocky Mountain Juniper/littleseed ricegrass • Stony cobbly gravelly Argiborolls •
Steep southerly granitic backslopes, 8,300-9,300 ft

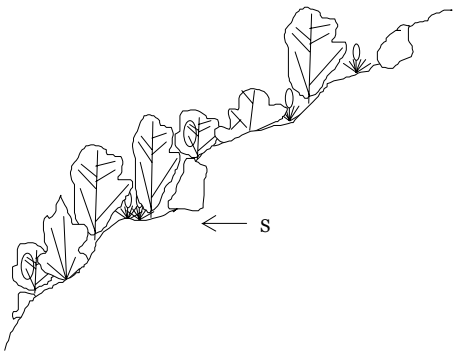

Figure 01-1. Cross-section of vegetation structure of *Tree juniper–Coarse dark soils–Steep southerly*. Aspects are southerly, and slope angles average 39%.

Tree juniper–Coarse dark soils–Steep southerly is a very common ecological type on rocky, steep southerly slopes, either inside or outside rainshadow climates. Rocky Mountain juniper (JUSC2), big sagebrush (ARTR2), and littleseed ricegrass (PIMI7) characterize this type; muttongrass (POFE) and pine needlegrass (ACPI2) are often present. Distinguishing features include short juniper trees, steep southerly slopes, sparse forest, very stony or bouldery, and soils that are shallow to large rock. See Table 01-9 for common species names and codes.

In the UGB, this type occurs in the Montane and Foothills belts, where it is very exposed to sun and moderately exposed to wind. It is found throughout western Colorado in cold, high-elevation parks and valleys.

The plant association *Juniperus scopulorum/Piptatherum micranthum*, newly described here, is in a distinctly different environment from *Juniperus scopulorum/ Oryzopsis micrantha* from the northern Great Plains (Nelson 1961, Hansen et al. 1984, Girard 1985, Hansen and Hoffman 1986).

Tree juniper–Coarse dark soils–Steep southerly is an open forest, with tree canopy cover averaging around 20%, rarely more than 35%. Total live cover is <120%, which is unusually low for a forested type. The shrub layer is variable, but there is typically some big sagebrush and rabbitbrush. There are few forbs, and grasses are sparse to moderate in cover. Grasses include blue grama, muttongrass, and Indian ricegrass in

sunny spots, while littleseed ricegrass and various mat sedges (CAGE, CAPEH) are found in the shady patches. Arizona fescue is present in a few stands, but it is never over 5% cover. Rocky Mountain juniper occurs sparsely in several other types, notably in lower-elevation Douglas-fir, aspen, and serviceberry types. In those types, juniper is clearly subdominant to other vegetation. Tree juniper can also occur in greater density in heavily browsed draws, where it is seral to cottonwood.

This type usually forms ecotones to one of the big sagebrush (ARTR2) types on gentler slopes, or to one of the drier Douglas-fir (PSME) types on more protected slopes.

These sites are too steep, unproductive, and too far from water for livestock grazing. Browsing, grazing, and trailing by wild animals leads to further invasion by big sagebrush and rabbitbrush, and leads to accelerated soil loss on these steep, dry slopes. After heavy use by deer, the juniper trees may become "highlined," and regeneration is eliminated.

Obstruction varies from moderately low to high. Deer make the most use of these sites, for hiding cover, browse, and forage. The communities are poor sage-grouse habitat because of steep slopes, low productivity, and low density of sagebrush. See Table 01-6 for wildlife preferences by community type.

Table 01-6. Wildlife values (relative to the whole UGB) for the principal wildlife species using *Tree juniper–Coarse dark soils–Steep southerly*.			
Community Type	Sage Grouse Season -- Preference	Mule Deer Season -- Preference	Elk Season -- Preference
A, B, C	Spring: Very Low (Lek) Nesting: Very Low Summer: Low	Winter, Mild: Moderate (Cover) Winter, Severe: Moderate (Cover) Spring/Fall: Moderate (Cover)	Winter, Mild: Low (Cover) Winter, Severe: Low Spring/Fall: Low

Summary of Ecological Type Characteristics

1. Explanation of symbols may be found in Appendix C. Percentages in [brackets] indicate the percentage of plots sampled that have that characteristic.

NUMBER OF SAMPLES	8, soil descriptions from 5 of these (total 8)
ELEVATION	8,920 ft (8,360-9,240 ft) 2,719 m (2,548-2,816 m)
AVERAGE ASPECT	171°M (r=0.60)
LITHOLOGY	Mostly granite [71%]
FORMATIONS[1]	Mostly Xg [83%]
LANDFORMS	Soil creep slopes
SLOPE POSITIONS	Backslopes
SLOPE SHAPES	Undulating [67%] to linear horizontally, concave [67%] to linear vertically
SLOPE ANGLE	39.2% (29-47%)
SOIL PARENT MATERIAL	Colluvium
COARSE FRAGMENTS	52.0% (40-66%) cover on surface, usually stony and/or bouldery; coarse fragments 55.8% (35-73%) by volume in soil
SOIL DEPTH	51 cm (28-80 cm) 20.0 in (11-31 in)
MOLLIC THICKNESS	12 cm (2-21 cm) 4.7 in (1-8 in)
TEXTURE	Clay loam and clay surface, clay and sandy clay subsurface
SOIL CLASSIFICATION	Argiborolls, moderately deep
TOTAL LIVE COVER	91.4% (51.7-117.5%). No. Species 31.9 (25-47)
TOTAL LIVE COVER/NO. SPECIES	3.1% (1.4-4.5%)
CLIMATE	In watersheds of moderate rainshadow, but in the upper portions of those watersheds and on southerly aspects, so dry to very dry, low precipitation. Warm to very warm, highly exposed to sun, and moderately exposed to wind.
WATER	Very dry microclimate, but vegetation cover and coarse fragments hold some moisture through the season on better-condition sites. No permanent water on or near sites.

Table 01-7. Resource Values for *Tree juniper–Coarse dark soils–Steep southerly*. Resource values were calculated from the numbers in Table 01-8, relative to the whole UGB.

The numbers in this table can be translated: 0 = Very Low, 1 = Low, 2 = Moderately Low, 3 = Moderate, 4 = Moderately High, 5 = High, and 6 = Very High.

	Community Type				Community Type		
Resource Value	**A**	**B**	**C**	**Resource Value**	**A**	**B**	**C**
Potential Cattle Forage Production	0-1	0-1	0-1	Sage Grouse Nesting/Brood Potential	1	1	1
Grazing Suitability	0	0	0	Sage Grouse Summer Potential	0	0-1	0-1
Developed Recreation	0-1	0-1	0-1	Need for Watershed Protection	4	5	5
Dispersed Recreation	1	0-1	1	Soil Stability	4	3	3
Scenic	2	1	1	Risk of Soil Loss-Natural	3	2	2
Road & Trail Stability	1	0-1	0-1	Risk of Soil Loss-Management	4	3	3
Construction Suitability	0	0	0	Risk of Permanent Depletion-Range	1	1	1
Deer & Elk Hiding Cover	5	4	2	Risk of Permanent Depletion-Wildlife	4	4	5
Deer & Elk Forage & Browse	3	2	2	Resource Cost of Management	3	3	3
Sage Grouse Cover	1	1	1	Cost of Rehabilitation	4	4	4
Sage Grouse Lek Potential	0	0	0				

Key to Community Types

1. Rocky Mountain juniper cover >45%. Littleseed ricegrass always present and >2% cover. Indian ricegrass (ACHY) <1% cover ..... **A**
1. Rocky Mountain juniper cover <45%. Littleseed ricegrass absent or <2% cover. Indian ricegrass >1% cover (2)

2. Big sagebrush subdominant, >10% cover. Blue grama (CHGR15) >15% cover..... **B**
2. Big sagebrush <10% cover. Blue grama absent or <5% cover ..... **C**

Description of Community Types

A *Tree juniper-muttongrass-sedge-littleseed ricegrass* has as full a canopy as Rocky Mountain juniper gets, 50-65% cover. Sparse littleseed ricegrass and other shade-loving plants are found in the shade of the junipers.

B *Tree juniper-blue grama-sagebrush* has a sparser canopy of juniper, 20-30% cover, with patches of sun-loving species in between, such as big sagebrush and blue grama.

C *Tree juniper-sagebrush-Indian ricegrass* has a still sparser canopy of juniper, 10-20% cover, with patches of different sun-loving species such as Indian ricegrass and sagebrush, and somewhat less-coarse soils.

Table 01-8. Community types (CT) within *Tree juniper–Coarse dark soils–Steep southerly*.

CT	No. Samples	Elevation, ft Slope, %	Coarse, % Depth, cm Mollic Depth, cm	Surface Coarse, % Bare, % Seral Stage	Lr	Layer Height, m	Avg Lyr Cvr %	Cover, %: Trees Shrubs Graminoids Forbs	No. Species Total Live Cover, % TLC/NS, %	Obstruction %: 1.5-2.0 m 1.0-1.5 m 0.5-1.0 m 0.0-0.5 m Total<2m
A. Tree juniper-muttongrass-sedge-littleseed ricegrass	3	8,837 (8,400-9,060) 37.0 (35-38)	55 (35-67) 46 (28-56) 12 (9-17)	48 (40-54) 6 (1-10) PN	T1 T2 S1 T3 S2 S3 GF M L	12 2.8 (1.5-4.0) 2.0 (0.7-4.0) 1.2 (0.2-2.1) 0.9 (0.2-2.0) 0.3 (0.0-0.7) 0.2 (0.0-1.2) 0.0 Missing	T 19.4 3.7 24.1 22.0 9.7 44.0 0.9 M	55 (48-63) 9 (3-21) 46 (27-59) 2 (1-2)	26 (25-28) 112 (106-117) 4.3 (4.0-4.5)	35 70 60 95 65
B. Tree juniper-blue grama-sagebrush	2	9,100 (9,060-9,140) 37.9 (29-47)	72 (70-73) 52 (47-56) 16 (10-21)	52 (46-57) 10 (7-13) LM	T1 T2 S1 T3 S2 S3 GF M L	12 2.4 (1.2-4.0) Missing 1.2 (0.2-2.1) 0.8 (0.3-2.0) 0.3 (0.0-0.8) 0.1 (0.0-1.2) Missing 0.0	T 20.0 M 6.3 10.3 12.4 44.8 M 1.3	23 (21-25) 22 (15-29) 50 (49-50) 4 (4-5)	29 (28-30) 99 (91-108) 3.4 (3.2-3.6)	50 50 50 40 48
C. Tree juniper-sagebrush-Indian ricegrass	3	8,883 (8,360-9,240) 42.3 (36-46)	41 (35-47) 58 (36-80) 9 (2-15)	56 (47-66) 12 (9-16) EM-MS	T1 T2 S1 T3 S2 S3 GF M L	* 1.5 (0.9-2.5) * * 0.6 (0.5-1.0) 0.1 (0.0-0.3) 0.3 (0.0-0.6) 0.0 Missing	T 12 T 6 14 6 32 1 M	16 (15-17) 16 (7-23) 30 (10-45) 3 (3-3)	39 (33-47) 65 (52-83) 1.7 (1.4-1.9)	13 (0-25) 23 (0-45) 18 (0-35) 53 (40-65) 26 (10-43)

*. Unknown: measurements were not taken in this CT.

Table 01-9. Common Species in *Tree juniper–Coarse dark soils–Steep southerly*, where Characteristic cover > 10% or Constancy > 20%. "–" means that the species is not found. Dead cover is not listed. Ccv = Characteristic Cover, Con = Constancy. If Avc = Average Cover, then these are related using the formula Avc = Ccv•100%/Con.

		COMMUNITY TYPE			
		A	B	C	
		Ccv(Con)	Ccv(Con)	Ccv(Con)	
Code	Species	N = 3	2	3	Common Name
	TREES				
JUSC2	Juniperus scopulorum	55(100)	23(100)	16(100)	Rocky Mountain juniper
PSME	Pseudotsuga menziesii	T (67)	T (50)	T (33)	Douglas-fir
	SHRUBS				
ARTR2	Artemisia tridentata	8(100)	14(100)	6(100)	big sagebrush
CHVI8	Chrysothamnus viscidiflorus	– –	6 (50)	4 (67)	Douglas rabbitbrush
ECTR	Echinocereus triglochidiatus	T (33)	T (50)	– –	hedgehog cactus
GUSA2	Gutierrezia sarothrae	T (67)	T (50)	T (67)	broom snakeweed
PUTR2	Purshia tridentata	1 (67)	3 (50)	1 (67)	antelope bitterbrush
RHART	Rhus aromatica ssp. trilobata	T (33)	T (50)	T (33)	skunkbrush
RIIN2	Ribes inerme	T (33)	– –	T (67)	whitestem currant
SYRO	Symphoricarpos rotundifolius	1 (33)	T (50)	3 (67)	mountain snowberry
	GRAMINOIDS				
ACHY	Achnatherum hymenoides	T (67)	1(100)	8(100)	Indian ricegrass
ACPI2	Achnatherum pinetorum	2 (33)	1(100)	2 (67)	pine needlegrass
CAGE	Carex geophila	1 (33)	– –	1 (67)	dryland sedge
CAPEH	Carex pensylvanica ssp. heliophila	10 (33)	– –	– –	sun sedge
CHGR15	Chondrosum gracile	5(100)	20(100)	2 (67)	blue grama
ELEL5	Elymus elymoides	7(100)	11(100)	3(100)	bottlebrush squirreltail
FEAR2	Festuca arizonica	1 (67)	4(100)	3 (33)	Arizona fescue
HECO26	Hesperostipa comata	T (67)	– –	– –	needle-and-thread
JUSA	Juncus saximontanus	– –	– –	15 (33)	Rocky Mountain rush
KOMA	Koeleria macrantha	2 (67)	9 (50)	– –	prairie junegrass
MUMO	Muhlenbergia montana	T (33)	T (50)	T (67)	mountain muhly
PASM	Pascopyrum smithii	– –	– –	1 (67)	western wheatgrass
PIMI7	Piptatherum micranthum	8(100)	1 (50)	1 (33)	littleseed ricegrass
POFE	Poa fendleriana	20(100)	6(100)	8 (67)	muttongrass
	FORBS				
ANSE4	Androsace septentrionalis	T (33)	– –	T (33)	northern rock-jasmine
ARFR4	Artemisia frigida	1 (67)	2(100)	1 (67)	fringed sagewort
BOFE	Boechera fendleri	– –	T (50)	1 (33)	false-arabis
CALI4	Castilleja linariifolia	– –	1 (50)	T (33)	Wyoming paintbrush
CHDO	Chaenactis douglasii	– –	T (50)	T (33)	pincushion
CHENO	Chenopodium	1 (33)	– –	1 (33)	goosefoot
EREA	Erigeron eatonii	– –	1 (50)	T (33)	Eaton fleabane
PECA4	Penstemon caespitosus	– –	T (50)	T (67)	beardtongue
PHHO	Phlox hoodii	– –	3 (50)	1(100)	Hood's phlox
PHRO4	Physaria rollinsii	– –	– –	T (67)	Rollins' twinpod
	GROUND COVER				
BARESO	bare soil	6(100)	10(100)	12(100)	
LITTER	litter and duff	44(100)	37(100)	31(100)	
GRAVEL	gravel 0.2-10 cm	4	20	15	
COBBLE	cobble 10-25 cm	17 (67)	6(100)	15(100)	
STONES	stone > 25 cm	30(100)	5(100)	14(100)	
MOSSON	moss on soil	3 (33)	– –	1 (33)	
LICHENS	lichens on soil	–	–	–	